2015-2017 Forestry Division

Problem Statements and Research Questions

Problem Statements – Priorities to be shared with Department	
A.	Some tree species are not successfully regenerating and, as a result, are becoming less common on the landscape. Information is needed on factors influencing natural and artificial regeneration, as well as urban plantings, to ensure that regeneration and planting efforts are successful.
B.	The public may be unaware of all of the values and benefits of Wisconsin forests, which may impact the implementation of sustainable forestry practices.
C.	Deer are impacting forest regeneration and affecting successional trends.
D.	Wisconsin's forest products industry operates within the global marketplace and information is needed on forest industry, including supply and demand for markets, to inform, among other things, business plans for forest industries in Wisconsin.
E.	Invasive non-native species are posing increasing threats to the environmental, social, and economic benefits of forests, including forest regeneration and ecosystem functions.
F.	Information is needed on the choices of private landowners and the way they currently manage their land.
G.	Information is needed on the economic value of Wisconsin's forests and forest industry.
H.	Northern hardwoods are one of the most abundant and economically important forest cover types in Wisconsin. Information is needed to ensure the sound management of this cover type for ecological, economical, and social benefits.
I.	The inability to accurately predict fire behavior conditions and understand public information needs can lead to inefficient use of resources to prevent, suppress, and control wild fires, as well as prevent the use of prescribed fire as an efficient land management tool.
J.	The long-term sustainability of intensive forest harvesting (such as biomass harvests and whole tree chipping) is unknown.
K.	Information is needed on forest ecosystem functions (forest productivity, wildlife habitat, water quality protection, air quality protection, and others) and the impacts of forest management, including recommendations and guidelines, on those functions to develop, evaluate, and refine forest management, recommendations and guidelines.
L.	Applied tools are needed to incorporate the best available research into current forest management practices.
M.	There are increasing demands on a fixed land base and sustainably accommodating multiple recreational demands within managed forests can be challenging.
N.	Large forest fire impacts are not fully understood and information is needed to address restoration following these types of fires.

A.	Some tree species are not successfully regenerating and, as a result, are becoming less common on the landscape. Information is needed on factors influencing natural and artificial regeneration, as well as urban plantings, to ensure that regeneration and planting efforts are successful.
Research Questions	
a.	What are the barriers for management on NIPF lands? What are effective methods to reduce barriers and provide opportunities to encourage management on NIPF lands, especially of difficult to regenerate species?
b.	Why is there a lack of oak regeneration on dry-mesic and mesic sites in southern Wisconsin? What methods can be used to regenerate oak when invasive shrubs and other competitors are present? Can prescribed fire be used for site preparation and competition control? Can planted oaks be used to supplement natural regeneration?
c.	What factors influence the success of urban tree plantings and tree growth, including urban micro-climates and environmental conditions, and the spread of invasive trees, pests, and pathogens? How can urban tree planting specifications and recommendations be improved to improve the likelihood for planting success and long-term tree health?
d.	Does a planting plan or forester involvement positively impact regeneration success?
e.	Mechanical scarification techniques are increasingly used to regenerate tree species that require frequent or intense disturbance regimes. What are the most successful scarification techniques and tools to regenerate Wisconsin forest tree species? What are the ecological impacts of using scarification systems on ground flora and soil nutrients?
f.	Why are white cedar, yellow birch, and eastern hemlock proving difficult to regenerate? What factors allowed these species to regenerate historically? What conditions are needed for them to survive in the future? What techniques can be used for reliable regeneration in the future?
g.	What methods can be used to successfully regenerate bottomland hardwood stands, especially in light of invasive species (e.g. RCG and EAB) and altered hydrological cycles along Wisconsin river systems?
h.	What is the genetic variability of tree species native to Wisconsin? What is the success of promising genotypes at different latitudes in the state? What species should be grown (or no longer grown) for artificial regeneration based on expected climate change trends?
i.	What factors have the most impact of seedling survival, such as browse damage, planting methods, site preparation, planting depth, competition, lift date, shipping date?
j.	What is the impact of urban trees on microclimate conditions in urban areas? How do urban trees respond to stress and harsh conditions (e.g., soil compaction, poor soils) in the urban environment, and how can specifications be improved to provide opportunities for urban trees to thrive in these environments? How do native versus non-native trees respond to these conditions?
k.	What factors influence natural jack pine regeneration and maintenance, such as shelterwood-fire techniques and seed source? What methods can be used to successfully regenerate jack pine? What are the ecological impacts? What are the costs/benefits of current and proposed methods, including impacts on fire mitigation and risk? Are there sites or conditions which result in more successful plantings from bare-root seedlings or containerized seedlings?
l.	What forest habitat and related tree species are likely to disappear with a temperature rise of 1° Celsius and 5° Celsius? Are there scenarios for assisted movement of tree species? What is the shift in species range within Wisconsin?

B.	The public may be unaware of all of the values and benefits of Wisconsin forests, which may impact the implementation of sustainable forestry practices.
a.	What is the current public opinion, awareness, knowledge level, attitude and values on Wisconsin forests, forestry and forest products? Have the results changed since the last survey, nearly 15 years ago?
b.	Were past education and outreach efforts effective in changing opinions?
c.	What factors influence stakeholder support for urban and community forest management and green infrastructure planning? What are the most effective tools and methods for communicating about the benefits of green infrastructure?
d.	What factors best position urban tree managers to most effectively communicate the need for and build resources to support urban tree maintenance and planting?
e.	What are effective opportunities for connecting communities, organizations, and urban tree managers with the needed resources, such as funding, for urban tree programs?
f.	What are the current urban forest messages being delivered by various organizations, agency programs, and other stakeholders (e.g., developers, planners), such as conditions for trees to thrive? To what degree are messages conflicting and complementary, and how are these messages interpreted and acted upon by stakeholders? Where are there gaps in messaging?
g.	How do stakeholders perceive the benefits of the "walkable community" and how do their perspectives impact management and planning for urban trees?
h.	What is the impact of the "Champion Tree" program on stakeholder perceptions and support for urban tree management? How does this program bridge the urban to rural interface of tree care and management?
C.	Deer are impacting forest regeneration and affecting successional trends.
a.	What are the impacts of deer browsing on forest productivity, understory plant abundance, bird and mammal populations, and forest ecosystem functions?
b.	What practices can be economically implemented to reduce deer browse to get a stand at an acceptable stocking level? Are there species preferred by deer and under what circumstances? Is deer or rodent damage more likely to impact seedling growth and form? What are the most successful and cost effective deer browse protection measures?
c.	How does deer densities and browsing effect herbaceous plants, woody shrubs, and tree seedlings?
d.	Can ecological carrying capacities be established for spatially and ecologically distinct ecosystems? Can socially and biologically acceptable deer densities be established to minimize deer impacts and enhance biodiversity?
e.	What are effective methods for communicating the impact of deer on urban tree planting success and reforestation goals and the need for managing the urban deer herd?
D.	Wisconsin's forest products industry operates within the global marketplace and information is needed on forest industry, including supply and demand for markets, to inform, among other things, business plans for forest industries in Wisconsin.
a.	What is the potential for developing new markets (foreign and domestic) for the forest products industry in Wisconsin?
b.	What is the supply and market for certified wood? What amount of certified wood is being produced? How is market access affected by possible shortages of source material, market preferences, development of primary and secondary manufacturing facilities, and impacts of the certification?

c.	What factors impact the long-term viability of the forest products industry in Wisconsin? What are the barriers and incentives to capital improvements and business start-up? What is the current and anticipated forest products workforce, and what factors influence the long-term viability of this workforce?
d.	What effect do land management changes, guidelines, and regulations have on the forest products industry in Wisconsin?
e.	What are the most effective tools and methods for communicating with stakeholders about market availability and end uses of the urban wood material? What are the barriers to the use of urban trees as a wood resource?
f.	How do traditional wood utilization companies perceive and potentially value the urban wood resource? What is the potential for conflict between the needs of the traditional forest products industry and the use of urban wood? What mechanisms can help build networks among arborists, mill operators, and consumers around the urban wood resource.
g.	What information is needed for a company to evaluate global markets and access to those markets?
h.	What factors influence the status and accessibility of local and regional markets for urban wood resources? What factors impact the use of urban trees as a reliable source for wood products? What is the balance between urban trees as a wood resource and the other benefits of urban trees, including social benefits, health and political?
i.	To what degree do urban trees differ in the structure of the wood from trees grown in rural areas (e.g., density, elasticity, rigidity, rupture), and how do these characteristics impact the use and value of the urban wood resource?
E.	Invasive non-native species are posing increasing threats to the environmental, social, and economic benefits of forests, including forest regeneration and ecosystem functions.
a.	What is the most cost-efficient and effective method to control the spread of oak wilt? Are herbicide treatments effective? Is the stump uprooting method effective? What insect vectors of oak wilt do we have? Can cellu-treat be used as a preventative treatment on cut stumps?
b.	What are effective strategies to encourage landowners to prevent annosum and oak wilt infection?
c.	What will be the effects of emerald ash borer on black ash swamps and low riparian areas and what should be replanted?
d.	How are invasive plants, insects and diseases spread through commonly used silvicultural practices? What are the points of entry? How can the spread be limited?
e.	How does the movement of firewood impact the spread of forest pests into the urban landscape? What is the pattern (seasonality, location, user types) and relative amount of firewood movement in the state? Where would a message concerning the spread of forest pests and firewood movement have the greatest impact on reducing movement?
f.	How can silvicultural techniques be modified to restore forest vegetation on sites where invasive non-native plants have already invaded? How can site preparation and planting practices be modified to limit the impact of invasive species?
g.	Does winter harvest decrease the probability of annosum infection? What is spore viability in the winter? If a stump is cut in the winter, is it susceptible to infection come spring thaw?
h.	What can be planted for reforestation efforts in an annosum pocket?
i.	Can annosum and Armillaria mortality pockets be controlled by applying herbicides to stumps?
j.	To what degree has EAB impacted the awareness of, and motivations to address, potential invasive pest infestations, among citizens and units of government? To what degree does EAB

	provide feasible and profitable urban wood projects, from the perspective of wood utilization companies?
k.	What is the historical context for Amynthas in Wisconsin and how will the worms affect the forests? How long have they been here? Where are all the infestations located? How are they being spread? What will change with the presence of Amynthas? What evidence do we have that demonstrates they are a problem?
l.	What is the public's opinion on invasive species movement and resulting behavior to prevent dispersal of invasive species?
m.	Can remote sensing be used to detect and monitor invasive plants populations?
n.	With what systems and when should foresters manage to regenerate tamarack during eastern larch beetle infestations?
o.	What are the long-term population dynamics of herbaceous non-native plant species?
p.	What is the impact of invasive species and "novel ecosystems" on ecosystem processes?
q.	What is the geographical extent and magnitude of beech bark disease in eastern Wisconsin?
r.	What are the potential impacts, including environmental persistence, of the use of chemicals that are commonly used in tree care, including the potential impact on bee colonies? How do citizens and other stakeholders view the costs and benefits of these chemicals?
s.	What is the loss of value to silver maple and oak due to staining caused by Columbian Timber Beetles?
t.	Do deer transmit phytoplasmas between plants?
F.	Information is needed on the choices of private landowners and the way they currently manage their land.
a.	What is the impact of our outreach and education programs on woodland owner pathways to action? What tools can help understand, track, and evaluate the impact of programs on woodland owners decisions to act? What is the short and long-term impact of innovative approaches for outreach and education, such as the Driftless Area Network on woodland owner's management actions and outcomes?
b.	What is the amount of forest management that is occurring on private woodlands? How does it differ on MFL versus non-MFL lands?
c.	Why does a landowner decide to renew or not renew participation in the MFL Program? What factors influence a landowner's decision? How important is the availability of cost sharing for management plans? Is third party certification a deciding factor? Is property tax reduction the primary factor? If a property is not re-enrolled, does it come back at a later date?
d.	What are the habits and desires of new landowners in regard to forest management? What management is occurring on vacation properties purchased over the last 20 years? How can we better assess forest management regularly occurring on private woodlands and assess management over time?
e.	What are the values and perspectives of property owners who own larger acreages (up to 10 acres), and what are the most effective tools to communicate with these property owners and influence sustainable tree care, management, and planning?
f.	What are private landowner values, attitudes, and management objectives and how have they changed over time?
g.	How can the state manage at landscape levels in coordination with privately owned lands in state forest boundaries? How can managers work with these landowners to coordinate management objectives? What are possible management strategies and how do we communicate with and interest landowners in this?

h.	How is forest management affected by changes in the economic climate? What is the impact of the recession on forest management choices by private landowners? What actions can respond to those changes?
i.	What tree species are considered preferred or acceptable by property owners and other stakeholders? What are the trends in tree species popularity, availability of nursery stock, public awareness, and impact on the urban canopy lifecycle? What mechanisms can incentivize tree nurseries to grow and cultivate new tree species?
j.	What factors impact management of the urban canopy across property boundaries and ownerships and what tools or mechanisms can be used to increase cross-property and broad-scale management?
k.	How do various stakeholders, including local leaders, communities, organizations, agency programs, professionals (e.g., architects), consumers, citizens, and property owners value the urban tree canopy and urban trees, including the use of urban trees as a wood resource?
l.	What factors, such as knowledge, beliefs, awareness, policies, and social connections, influence the behavior of property owners to effectively maintain and expand the urban tree canopy?
m.	What ecological, economic and social factors threaten the values that stakeholders hold for the urban tree canopy?
n.	To what degree are property owners willing to invest in their urban tree canopy?
o.	What are the needs and potential benefits of licensing for municipal tree management?
G.	Information is needed on the economic value of Wisconsin's forests and forest industry.
a.	What is the role of forested lands in local economies, including direct and indirect use values, such as woody biomass, outdoor recreation, ecosystem function, and their underlying natural resource stocks? What are their economic contributions to local and statewide regional delineations?
b.	What are the most inclusive and efficient ways to integrate both long-term and short-term economic concerns into sustainable forest management?
c.	What information should foresters collect to provide more usable data on timber value as timber supply, demand, and price change over time? What changes could be made to allow tracking of timber values from timber sales that DNR foresters are involved in?
d.	How do species, age, site characteristics, current value, silviculture guidelines, economics, product considerations and other factor influence harvest decisions in hardwood stands? What is the economic sweet spot?
e.	How can ecological services be valued? What are the strengths and weaknesses of various valuation methods? What is the valuation outcome for forestlands under varying management strategies and across different ownerships?
f.	What is the value and cost of public lands to local governments, including taxes and costs of services? What are the costs, such as infrastructure and services, of private forestlands to local governments compared to other land uses?
g.	How is material infected with EAB being removed? How is it being used? What can communities do to minimize cost of ash removal and maximize use of wood supply?
h.	What physical and socio-economic constraints limit the amount timber that is harvested? How can this data be used to improve estimates of volume of timber available for harvesting from FIA?
i.	What impacts do limited markets for small diameter and poor quality wood have on silvicultural practices in southern Wisconsin? How can these markets be developed?
j.	What is the impact of land use value assessment methods on forest management?
k.	What are the monetary values of providing public access on privately owned forestlands, including fixed term and perpetual easements? What are the barriers for NIPF landowners to providing

	public access on privately owned forestlands? What mechanisms can encourage public access?
l.	What is the impact of sales of industrial forestlands on employment, public access, development, cost of services, and various economic indicators?
H.	Northern hardwoods are one of the most abundant and economically important forest cover types in Wisconsin. Information is needed to ensure the sound management of this cover type for ecological, economical, and social benefits.
a.	Uneven-aged management systems for northern hardwoods are complex. Are single tree and group selection regeneration methods being applied successfully in Wisconsin? Are managed northern hardwood stands achieving appropriate uneven-aged structures and developing a regulated flow of forest products?
b.	Northern hardwood standards are exposed to a number of stressors that are limiting regeneration success, including deer, earthworms, sedge, other competing vegetation, poor silvicultural practices and altered disturbance regimes. How can regeneration of northern hardwoods be improved?
c.	How can degraded hardwood stands be managed to increase timber productivity?
I.	The inability to accurately predict fire behavior conditions and understand public information needs can lead to inefficient use of resources to prevent, suppress, and control wild fires, as well as prevent the use of prescribed fire as an efficient land management tool.
a.	What is the cost/benefit of response based on fire danger ratings, including staffing levels and efficiencies?
b.	What is the cost/benefit of investments in: a) hazard mitigation fuel reduction projects, and, b) Community Wildfire Protection Plans (CWPP) in preventing losses of life, property and resources during Wisconsin forest fires?
c.	What is the accuracy of the National Fire Danger Ratings System (NFDRS) and Canadian Fire Danger Rating System (CFDRS) fuel models to fuel types found in Wisconsin? Do the models accurately predict actual fire behavior observed throughout the year?
d.	What is the cost/benefit of investments in forest fire prevention efforts in Wisconsin? How can these efforts be further focused and refined?
e.	What is the cost/benefit of fire suppression in different fire landscapes?
f.	What is the cost/benefit of mechanical, chemical and prescribed burn applications to accomplish land management objectives for fire dependent communities? How do public perceptions (landowners, community leaders, local government, citizens, homeowners) affect the utility and success of these applications?
g.	What is the validity of the components utilized in the development of the fire landscape system used in the Fire Program Assessment? Can fire suppression efforts to actual fire losses incurred be used to strengthen the overall fire risk map used in Wisconsin?
h.	What are the prescribed burn intervals required for the restoration and maintenance of fire dependent communities? What are the long-term impacts on forest products?
i.	What is the need and benefit in introducing fire into fire dependent communities across Ecological Landscapes?
j.	What are the prescribed burn windows for fire dependent communities, outside normal spring fire seasons, that will permit land managers more opportunities to accomplish land management objectives?
k.	What is the potential for increased fire risk with increasing temperatures and evapotranspiration?
l.	What are the carbon emissions that result from various types of burning?

J.	The long-term sustainability of intensive forest harvesting (such as biomass harvests and whole tree chipping) is unknown.
a.	What is the impact of woody biomass harvesting retention levels and patterns on tree regeneration, habitat and biodiversity, invasive species, and soil nutrient cycling? What are the long-term impacts of climate on those relationships?
b.	How much woody debris is needed to be left on dry nutrient-poor sites as a target? Are there effective strategies for mitigating the impact of biomass harvesting on dry nutrient-poor sites, with considerations for operability and costs?
c.	What is the long-term impact of biomass harvesting on soil nutrients and the presence, abundance, and demographics of selected animal and plant species?
d.	What is the impact of the biomass harvesting guidelines on landowners, from a policy (cost/benefit) analysis?
e.	What is the landscape level implementation and implications of biomass harvesting at different levels?
f.	How does the amount of coarse and fine woody debris following a harvest vary by forest and site types, age, equipment and season?
g.	What are the site impacts of biomass harvesting compared to historic natural disturbance, such as fire?
K.	Information is needed on forest ecosystem functions (forest productivity, wildlife habitat, water quality protection, air quality protection, and others) and the impacts of forest management, including recommendations and guidelines, on those functions to develop, evaluate, and refine forest management, recommendations and guidelines.
a.	What are the impacts and effectiveness of various forest management guidelines, including silviculture practices, BMPs, forest health guidelines, species guidance, and other recommendations? Are they achieving their intended results? Is there the opportunity for more flexibility in the implementation of the guidelines and what are the consequences of not following the guidelines? How can this information be used to develop, evaluate, and refine guidelines?
b.	What are the characteristics (e.g., age structure, species diversity, % canopy) of a sustainable urban tree canopy?
c.	What forest locations are best for managing for a combination of resources, to maximize benefits while providing social and economic uses? What alternative forest management scenarios could be used to identify the best alternative for maintaining sustainable representation of natural community types?
d.	What is the impact of the urban tree canopy, and characteristics of the canopy, such as the use of native and non-native tree species, on stormwater management and water quality and quantity?
e.	What are the costs and benefits of current trends and projected changes in the urban tree canopy, including impacts related to the spread of invasive pests and pathogens, and other stressors, such as land use change?
f.	What is the carbon storage and transfer in various forest types under different management scenarios? What are the impacts and benefits of afforestation on carbon storage? What incentives or information would encourage landowners to take action and plant trees (rural or urban)?
g.	How can structural attributes of old-growth forests be created in older second-growth forests? What is the effect of these structural elements on wildlife, forest productivity, carbon storage, and other ecosystem functions?
h.	What are the functional differences between common, managed ecosystems of different forest

	types and their less-disturbed counterparts? Is there a collection of reference of benchmark areas that can be used for comparisons?
i.	What effect does landscape restoration principles and practices, including the role of fires and other disturbance regimes, have on landscape processes, function, and resiliency?
j.	What is the effect of management on landscape-scale forested ecosystems, including cumulative and indirect effects, on things such as habitat for interior songbirds?
k.	What is the effect of changes in forest cover on hydrology with a temperature rise of 1° Celsius and 5° Celsius?
l.	What is the function of coarse woody debris, including its contribution to wildlife habitat needs, nutrient cycling, and regeneration?
m.	What is the effect of forest succession on wildlife species?
L.	Applied tools are needed to incorporate the best available research into current forest management practices.
a.	What methodologies and tools are most effective for calculating the ecosystem service benefits (e.g., stormwater management, health benefits, economic impacts) of the urban tree canopy at the state and local levels in Wisconsin?
b.	What forest regeneration monitoring systems, including the use of new technology, can be utilized to improve regeneration management decisions?
c.	Monitoring is frequently recognized as a need, but infrequently implemented. What are institutional barriers to implementing monitoring programs? What are the most efficient ways to integrate monitoring into management?
d.	What are the best and/or most efficient forest cruising/ reconnaissance systems for use in Wisconsin?
e.	What methodologies and tools are most effective for calculating the status and trends of the urban tree canopy at the state and local levels in Wisconsin?
f.	How can LIDAR technology be used to improve stand assessment and management for multiple objectives?
M.	There are increasing demands on a fixed land base and sustainably accommodating multiple recreational demands within managed forests can be challenging.
a.	What is the environmental damage is associated with various motorized uses, including trail erosion, illegal trail creation, off-trail use, and spread of non-native invasive plants? What is the extent and magnitude of these impacts? How can they be mitigated?
b.	How satisfied are various recreation users with opportunities across the state? What type of experience is preferred by various recreation users, including campers, motorized recreationists, and others?
c.	What is the willingness of user groups to share space with other users?
d.	What are the common traits in areas used for illegal drug production to aid in the identification of lands that may be used for such activities and to ensure public and employee safety?
e.	What are the drawbacks of the state reservation system for camping? Have improvements addressed the original issues with the system?
N.	Large forest fire impacts are not fully understood and information is needed to address restoration following these types of fires.
a.	How should post-fire assessments for large, intense forest fires be conducted and information should be gathered? What is the effectiveness of fuel breaks and impacts on forest regeneration,

	soil conditions, water quality and terrestrial impacts? What best management practices are needed to rehabilitate areas impacted by such fires?
b.	Following a large forest fire, under what scenarios should landowners consider immediate reclamation versus allowing for natural regeneration to occur? Under what circumstances does under-planting prove successful?